SOILS/WATERSHED

Runoff from the Billings Resource Area drains into the Yellowstone, Musselshell, Clarks Fork of the Yellowstone, Boulder, Stillwater or Bighorn River (see Table 3.3 for flow data for these rivers). Each major stream is characterized by a dendritic pattern of tributary streams that range from ephemeral (very short-lived) to perennial (present all year). Most of the land uses proposed by this resource management plan (RMP) will be along the Yellowstone mainstem, or in the drainage basins of the Clarks Fork of the Yellowstone or the Musselshell River.

TABLE 3.3: FLOW RECORDS FOR PRINCIPAL RIVERS

	Average Flow (CFS)	Maximum Flow (CFS)	Minimum Flow (CFS)
Musselshell River	229	9,160	.6
Yellowstone River	7,038	69,500	430
Clarks Fork of Yellowstone	1,199	11,800	88
Stillwater River	969	12,000	58
Boulder River	616	9,840	10
Big Horn River	3,970	59,200	275

Source: Water Resources Data for Montana, USGS, 1982

The Yellowstone River, one of the longest free-flowing rivers in the U.S., enters the resource area near Springdale, Montana and flows approximately 150 miles before leaving the resource area at the eastern boundary. The Yellowstone River, from the Yellowstone National Park boundary to Pompey's Pillar, is a stream segment which is subject to Section 5(d) of the Wild and Scenic Rivers Act (PL 90-542). There are 170 square miles of public land in this portion of the Yellowstone River Basin, excluding the Clarks Fork of the Yellowstone.

The Musselshell River begins in the Castle Mountains of central Montana, outside the resource area boundary. The river flows east for 125 miles then turns north and leaves the resource area east of Melstone, Montana. There are 179 square miles of public land in this portion of the Musselshell River Basin.

The Clarks Fork of the Yellowstone River originates in Wyoming and enters the resource area at the Montana state line near Belfry. It flows approximately 60 miles north to its confluence with the Yellowstone River near Laurel. There are 261 square miles of public land in this portion of the Clarks Fork Basin.

Approximately 57 square miles of public land in Carbon County provide runoff to the Bighorn River.

The Stillwater River originates in the Beartooth Mountain Range of southern Montana on U.S. Forest Service lands and flows approximately 53 miles to its confluence with the Yellowstone River near Columbus, Montana.

The Boulder River originates on U.S. Forest Service lands in the Absaroka Mountain Range and enters the resource area at the Park/Sweet Grass County line. Approximately 24 miles of this river flow through the resource area.

A high percentage of the annual runoff (Rioux and Dodge, 1979) occurs March through June. Snowmelt, intense rain storms and saturated or frozen soils are some factors contributing to high runoff during the spring. Severe thunderstorms in the summer months generally do not result in flooding. These intense storms are significant because soils in the resource area are subject to a very high hazard of water erosion.

Soils in the Billings Resource Area are derived mainly from sedimentary bedrock and alluvium. Differences in climate, parent material, topography and erosional conditions result in soils with diverse physical and chemical properties. Following is an overview of the four geomorphic groups and associated soils present in the area.

Geomorphic Group One, Shale and Sandstone Uplands: These are soils of the shale and sandstone uplands occurring throughout the area. The depth of soils in this group will range from very shallow to deep, and their texture is mainly loamy in the surface layers with local areas of clayey or sandy textures. The number of rock fragments and amount of calcium carbonate (lime) in these soils will vary depending on the kind of bedrock found locally. The terrain is usually gently rolling to very steep highly dissected landscapes.

Geomorphic Group Two, Floodplains, Stream Terraces and Fans: This group includes soils of the floodplains, stream terraces and fans found throughout the area. This group contains deep, nearly level to strongly sloping soils that are well drained to very poorly drained. Soil textures range from loamy fine sand to clay. The number of rock fragments will be more numerous along terrace edges near fast moving water areas. These soils are formed in alluvium dissected by incised water channels.

Geomorphic Group Three, High Terraces and Benches: This group includes the soils of high terraces and benches occurring mainly in Carbon, Musselshell and Yellowstone Counties. This group comprises deep, well drained soils on nearly level to moderately sloping terrain dissected by deep drainages. Their textures are mainly loamy or loamy-skeletal and high in calcium carbonate. These soils are formed in gravel outwash and alluvium from mixed rock sources.

Geomorphic Group Four, Mountains and Foothills: This group includes soils of the mountains (Beartooth, Bull, Crazy, Pryor and Snowies) and foothills areas within the Billings Resource Area. Soil depth runs from very shallow to deep, depending on proximity to rock outcrops. They are well drained, and are on gently sloping to very steep, dissected terrain. The texture is loamy or loamy-skeletal with high calcium carbonate in soils of the Pryor and Snowy Mountains. These soils are formed from material derived from sedimentary, igneous and metamorphic rocks.

Soil survey data was obtained from the Yellowstone County Soil Survey (1972), the Carbon County Area Soil Survey (1975), the Order 3 Soil Survey of Golden Valley-Musselshell Area (1978) and soil and vegetation inventory updates for parts of these areas in 1981. Scattered tracts of public land in Big Horn, Golden Valley, Stillwater, Sweet Grass and Wheatland Counties will not be considered specifically in the evaluations due to lack of information.

Erosion

The erosion hazard rating is the susceptibility of a soil to erosion when bare of vegetation. The soils on public land in the Billings Resource Area have a high erosion hazard from both wind and water due to the slope of land, the kind and amount of ground cover, the high calcium carbonate (lime) content and the low organic matter in surface layers. Good vegetation cover reduces both wind and water erosion.

Soils in the south Carbon County area are mainly in geomorphic soil groups ONE, THREE and FOUR. Weather records show that wind gusts up to 70 miles per hour are not uncommon. Soils that are sparsely vegetated and only slightly disturbed are subject to a high soil blowing hazard. Soils high in lime are especially vulnerable to soil blowing, as it contributes to the flocculation of soil particles. This enhances their detachment from the soil mass and they are thus easily airborne. Since most of the soils in the area have some lime in the surface layers, this phenomenon contributes to the very high wind erosion hazard. Soils especially high in lime are those developing in material weathered from limestone. Soils on the foothills, fans and terraces in and adjacent to the limestone areas of the Pryor Mountains are thus subject to a very high soil blowing hazard.

The hazard of water erosion is high even though the average annual precipitation is quite low over much of the area. Most of the precipitation falls from April through June with a high probability of intense rain storms during this period. At this time the many very shallow and shallow, sparsely vegetated soils with slopes greater than 8% are subject to a very severe hazard of water erosion. The reason these soils are especially vulnerable to water erosion is because they only have the capacity to hold from less than 0.5 to a maximum 4 inches of water. Often these soils reach their maximum water storage capacity early in April, and the runoff potential from additional precipitation becomes high. Other soils with slopes greater than about 15% are also subject to water erosion if not suitably protected by vegetation. The effects of water erosion throughout south Carbon County are visible on much of the terrain.

Soils in the northern part of Yellowstone County are mainly in geomorphic soil group ONE. Narrow areas of alluvium along water courses are in group TWO. These soils are weathering from calcareous shale and sandstone. Annual precipitation of 12 to 14 inches, and low organic matter content combine to create a high water erosion hazard on slopes greater than 15%.

Soils north of the Musselshell River in Musselshell County are mainly in geomorphic soil groups ONE and THREE. Narrow areas of very strongly salt and sodium affected alluvium of soil group TWO lie along water courses. These soils are weathering from calcareous and acid shales, and from sandstone. The high terraces and benches are outwash from mixed rock sources (limestone, sandstone and shale). Annual precipitation of 11 to 14 inches, and low organic matter content create a high water erosion hazard on slopes greater than 15%. Bare soils are susceptible to severe to very severe soil blowing due to lime content, low organic matter in surface layer and soil textures. The most effective means to control both wind and water erosion is by maintaining a suitable vegetation ground cover and by minimizing soil disturbance.

Runoff

Runoff in this resource area varies according to dominant range sites within a respective watershed, and a number of precipitation variables. Analysis of runoff, in this RMP, uses soil groupings (see Appendix 3.1) as separate ecological units. To eliminate evaluating runoff under varying precipitation events (i.e., intensity, magnitude), the average annual runoff will be used, and quantified in acre-feet/acre.

Using these soil groupings, an average annual runoff constant will be given to each grouping. The soil groupings are correspondent to dominant range sites. Soil groups 1, 2 and 3 will produce .06 acre-feet/acre for loamy textured soils; .08 acre-feet/acre for fine textured soils; and .04 acre-feet/acre for loamy and clayey textured soil areas in the 5-9" precipitation zone of Carbon County. Soil group 4 will produce .20 acre-feet/acre. Since sandy textured soils represent a small percentage of land area, runoff from these areas is insignificant.

Runoff can also be discussed using runoff potentials or hydrological soil groups. A hydrological soil group has been defined as one of four categories of runoff potential soils can have. The four categories range from low runoff potential to high runoff potential (Soil Conservation Service, 1972). Appendix 3.1 aligns the various soil groupings used in this document with a hydrological soil group. In Chapter 4 both the average annual runoff and the runoff potential will be analyzed in those land areas where runoff is affected by BLM's actions.

Water Quality

Water quality in the rivers and streams in the resource area is generally good (see Table 3.4). Pollution problems are primarily non-point source oriented related to agricultural practices, with sediment and salinity the two most common forms of pollution. However, fecal coliforms in excess of state standards have been recorded from various sampling sites. Particular problems (increases in sodium and sulfate salts and dewatering) have been identified on the lower Musselshell River (Hills, 1977) and Silvertip Creek. The BLM is also concerned about water quality in its man-made reservoirs, which range from small livestock ponds to large irrigation reservoirs.

The "208 Planning" program, a cooperative planning program between Federal and state governments (Water Pollution Control Act of 1972, Public Law 92-500, Section 208), is aimed at identifying areas of non-point sources of pollution and methods to control these problems. Portions of a 208 planning area include Sweet Grass, Stillwater, Yellowstone and Carbon Counties. The BLM's involvement in the "208 Planning" program includes a yearly report of BLM's monitoring programs to the State Water Quality Bureau.

Streambank Erosion

Riparian areas are wetland areas bordering rivers and streams. These vegetative classifications and types are defined in Appendix 3.2. Streamside vegetation provides a filter against the overland flow that carries sediment and other pollutants into streams. Streamside vegetation stabilizes channel banks against cutting action, controls water pollution, regulates stream flows, influences water temperature and enhances subsurface groundwater recharge (Holechek, 1980 and Shovlin, 1982). There are 30 miles of public land segments adjacent to major rivers and their tributaries in this resource area that provide for excellent woody floodplain type. There are 41 miles of perennial and intermittent streams in the "I" allotments having segments of woody floodplain type potential.

Water Use

In 1979, BLM began filing water rights applications and claims with the State of Montana Department of Natural Resources and Conservation (DNRC). To date, BLM has filed for 463 water sources with the state. These water claims are either provisional permits or prior use claims. Water right applications have been filed on reservoirs, springs and wells. The resource area will continue to apply for Montana State water use permits on all proposed water developments.

TABLE 3.4: SUMMARY OF SELECTED WATER QUALITY PARAMETERS

	Specific Conductance Micromhos	pH	Fecal Coliform Cols./100 ml.	Hardness Mg./L.	Alkalinity Mg./L.	Sulfate Mg./L	Sediment Concentration Mg./L.	Temp. °C
Musselshell River[1]	678 to 4900	8.1 to 8.5	1 to 3200	340 to 990	150 to 370	300 to 1200	20 to 7110	0° to 34.5°
Yellowstone River[1]	140 to 720	7.1 to 8.5	36 to 540	70 to 210	59 to 160	26 to 130	1 to 4260	—
Clarks Fork of the Yellowstone[1]	160 to 1280	7.0 to 8.8	9 to 5500	54 to 395	60 to 228	16 to 332	118 to 850	0° to 22.5°
Stillwater River[1]	45 to 270	6.7 to 8.7	—	22 to 110	19 to 89	4.5 to 30	—	0° to 13°
Boulder River[1]	43 to 117	—	—	17 to 44	19 to 37	.8 to 10	2 to 223	0° to 15.0°
Bighorn River[1]	384 to 1940	8.0 to 8.7	20 to 57	280 to 430	150 to 210	270 to 470	20 to 146	0° to 30.0°
Silver Tip Creek[2]	6000 to 8000	7.9 to 8.3	—	—	—	—	0.1 to 30	1° to 29°
Bridger Creek[2]	1525 to 2350	7.7 to 8.4	—	—	—	—	0.0 to 152	11° to 25°
Gyp Creek[2]	2020 to 4000	7.5 to 8.5	—	—	—	—	0.1 to 3.7	4° to 20°
Halfbreed Creek[3]	1380 to 1850	8.0 to 8.4	—	540 to 680	430 to 580	380 to 550	8 to 80	.5° to 22.5°
West Parrot Creek[3]	1250 to 1340	8.0 to 8.5	—	300 to 380	340 to 420	290 to 320	4 to 12	11° to 19.5°
Fattig Creek[3]	1300 to 2040	8.2 to 8.7	—	470 to 710	320 to 480	410 to 770	4 to 46	9° to 26°

Sources:
[1]Water Resources Data for Montana, USGS
[2]BLM Inventory
[3]Hydrologic Data From the Bull Mountains Area, South-Central Montana, USGS

Groundwater

The resource area is underlain by sandstones and limestone that provide large quantities of water to wells. In the northern portion of the area, wells drilled to the Kootenai formation yield up to 50 gallons of good quality water per minute. In the Pryor Mountain area, wells and springs reportedly yield up to 1 million gallons of water per day from the Madison Limestone. Water quality is good for domestic and agricultural uses (Miser, 1930). Other formations may yield smaller quantities of water acceptable for these uses.

In the Bull Mountain area, water supplies are not as dependable as elsewhere in the resource area. Groundwater apparently occurs in perched aquifers. Springs or seeps are located near outcrops of the Mammoth-Rehder coal bed. The water quality of springs is good, with calcium, magnesium and bicarbonate the principal ions. Deeper aquifers are present, but at depths that vary from several tens of feet to several hundred feet. The deeper aquifers have lower quality water with sodium and sulfate ions predominate (Rioux and Dodge, 1979). It has not yet been determined if the coal beds in the Bull Mountains serve as aquifers. A study being conducted by the Montana Bureau of Mines for BLM is aimed at determining groundwater characteristics in order to assess impacts of coal mining on the groundwater resource of the Bull Mountains.

VEGETATION

The Soil Conservation Service has identified five broad geographic zones in Montana to aid in describing the range sites and native vegetation. Parts of three of these zones, the Eastern Sedimentary Plains, Western Sedimentary Plains and Foothills and Mountains are within the Billings Resource Area (see Climax Vegetation Map 2—Map Pocket).

The Eastern Sedimentary Plains zone encompasses the area between the Musselshell and Yellowstone Rivers and east of the Roundup/Billings highway. This area includes approximately 110,000 acres of public land and is within the 10-14 inch precipitation zone. Vegetation consists primarily of big sagebrush, bunch grasses, western wheatgrass and a zone of the ponderosa pine/grassland type.

The Western Sedimentary Plains include a variety of vegetative types. This zone takes in essentially all of northern Musselshell, Golden Valley, Wheatland and western Yellowstone Counties; those portions of Stillwater and Sweet Grass Counties north of the Yellowstone River; and the Clarks Fork Valley and Triangle area in Carbon County. Precipitation ranges from 6 to 19 inches. This zone includes approximately 260,000 acres of public land. Vegetation consists primarily of sagebrush/grassland and grassland types, though it does include the red desert/saltshrub type on the Wyoming border in southern Carbon County, as well as some ponderosa pine/grassland type vegetation.

The remaining 55,000 acres of public land in the Billings Resource Area are located in the foothills and mountain zone. This includes the Pryor Mountains, the north face of the Beartooth Mountains and the south face of the Big Snowy Mountains (for specific range site and vegetation information, see Climax Vegetation, SCS, 1976).

During the spring and summer of 1981 the resource area personnel conducted inventories to collect baseline soil and vegetation information for this RMP. Due to limitations in manpower and funding, the inventory was limited to areas where BLM lands are concentrated. Consequently, this inventory was confined to the larger tracts of public land in Carbon, Yellowstone and Musselshell Counties. A total of 331,725 Federal acres were inventoried in these three counties. This included approximately 2,500 acres of Forest Service land on the Pryor Mountain Wild Horse Range and about 25,000 acres of National Park Service lands in the Bighorn Canyon National Recreation Area.

The inventory was designed to update and refine existing soils information to the extent that range sites could be defined within the soil mapping units. In addition to mapping range sites, an ecological range condition was assigned to each site (see Table 3.5). This condition estimate is based on the current vegetative composition and production as compared to a comparable range site under climax or pristine conditions. Vegetative types were also identified, the canopy coverage of shrubby species was estimated, and an estimate of apparent trend was made.

TABLE 3.5: RANGE SITE/CONDITION CLASS, BY ACREAGE

5-9" Precipitation Zone

RANGE SITE	CONDITION CLASS EXCELLENT	GOOD	FAIR	POOR
Clay Pan		50	86	
Clayey	2,309	9,155	15,195	1,707
Dense Clay		1,809	8,516	1,247
Gravel		2,509	2,035	7
Grazable Woodland			1	
Lowland		7	237	149
Overflow			22	
- Clayey		39		
Saline		4	147	93
- Lowland	18	143	244	19
- Upland		1,580	951	107
Sandy	1,475	4,650	1,684	31
- Stony		52	5	
Shallow	5,423	13,262	11,948	978
- Clay	518	4,059	2,402	71
- to Gravel		644	1,185	4
- Limy		962	4,597	2,039
- Sandy		74	84	
Silty	600	3,714	10,513	405
- Limy		537	208	4
- Limy-Stony		215	216	472
Stony	70	2,826	3,423	857
Subirrigated	17	1		
Thin Clayey	64	1,180	3,006	43
Very Shallow	2,754	6,114	1,854	854
- Limy		1,417	5,075	2,618
Wetland	6			
(Acres)	13,254	55,063	73,634	11,705

10-14" Precipitation Zone

RANGE SITE	CONDITION CLASS EXCELLENT	GOOD	FAIR	POOR
Clay Pan	15	327	65	
Clayey	299	13,964	3,707	3
Coarse Clay		68	35	
Dense Clay		842	682	
Gravel			16	
Grazable woodland		54	57	21
Clayey		543	132	
Sandy		955	23	
Shallow		3,365	352	
Silty		54	2	
Thin Clayey		331	12	
Thin Silty		3,748	769	
Lowland		2	27	
Overflow		200	201	
Saline		1	16	
- Lowland		145	96	
- Upland		997	151	
Sands		166	17	
Sandy	33	4,346	1,112	17
- Stony		508		
Shallow	30	6,432	1,856	95
- Clay		704	370	
- to Gravel		1,294	225	
- Limy	42	4,899	6,355	2,673
- Sandy		164	752	59
Silty	190	17,584	7,696	1,355
- Limy		254	127	21
- Limy-Stony		53		13
- Saline	3	52	34	
- Stony	3	1,499	3,883	2,566
Subirrigated		35	23	
Thin Clayey	59	6,210	1,468	3
Thin Sandy			8	2
Thin Silty	92	10,404	3,685	44
Very Shallow	6	1,435	745	173
- Limy	69	2,971	5,854	1,377
(Acres)	841	84,406	40,553	8,402

15-19" Precipitation Zone

RANGE SITE	CONDITION CLASS EXCELLENT	GOOD	FAIR	POOR
Grazable woodland	24	5	20	20
Sandy			10	
Sandy-Stony		26	3	
Shallow	36	132		6
Shallow-Limy	120	252	406	98
Shallow-Sandy		112		
Silty		277	454	
Silty-Stony	57	891	204	59
Thin Clayey		57		
Very Shallow	131	67		
Very Shallow-Limy	144	383	151	118
(Acres)	512	2,182	1,248	281

Summary

CONDITION CLASS

PRECIPITATION ZONE	EXCELLENT	GOOD	FAIR	POOR
5-9	13,254	55,063	73,634	11,705
10-14	841	84,406	40,553	8,402
15-19	512	2,182	1,248	281
(Acres)	14,607	141,651	115,435	20,388

Totals for all zones and classes	292,081
Acreage in crested wheat	12,983
Rock outcrop	18,104
	323,168

Source: Ecological Site Inventory, BLM, 1981

The overall range condition in the inventory area (exclusive of the Pryor Mountain Wild Horse Range) is 14,607 acres (5%) in excellent condition, 138,876 acres (49%) good, 102,932 acres (36%) fair, 12,488 acres (4%) in poor condition, 12,983 acres (4%) tame pasture and 6,839 acres (2%) rock outcrop (see Table 3.6).

Seventy percent of the fair and poor range condition acreage is in the 22 allotments categorized as "I" or Improve. The "I" allotments total 87,679 acres of which 6,953 acres (7.9%) are in poor condition, 36,161 acres (4.2%) are in fair condition, 35,608 acres (40.6%) are in good and excellent condition. Also 5,118 acres are in tame pasture and 3,839 acres are unsuitable rock outcrop.

The inventory of the PMWHR did not include the 6,083 acres in Big Horn County, Wyoming. Of the 38,213 acres inventoried, 2,775 acres are in good condition, 12,498 in fair, 7,900 in poor and 15,040 unsuitable to wild horse grazing.

The poor condition areas are dominated by invader species; annuals, cactus and weeds and increaser species like sagebrush, fringed sagewort and Sandberg bluegrass. Fair condition areas are dominated by increaser species but include small amounts of decreaser plants. Changes in range condition are brought about primarily by the intensity of past grazing use. Low forage production and accelerated erosion are generally associated with poor and fair range condition.

The trend in range condition and actual use have been monitored on the 24 existing allotment management plans (AMPs) and is summarized in Table 3.7. No trend information is available for other allotments.

Current problems that contribute to unsatisfactory range condition include poor livestock distribution which causes overuse of preferred areas, possible overstocking in two allotments, noxious weed invasion and season long grazing. Recent efforts have been made to balance the numbers of wild horses in the Pryor Mountain Wild Horse Range (PMWHR) with the available forage.

The range sites of the inventory area have been classified by BLM range conservationists and soil scientists as to their capability to improve in condition in response to grazing treatments of rest and deferment. The suitability for mechanical treatments has also been determined. This information is summarized in Appendices 3.3 and 3.4.

A number of factors limit the improvement potential of some of the unsatisfactory condition rangeland. Dense sagebrush (25% or more canopy cover) limits improvement on 30,000 acres. Of the total Federal acres surveyed, about 157,000 acres were of a sagebrush (*Artemesia tridentata*) aspect. Dense stands of sagebrush substantially reduce both the quality and amount of vegetative production, thus adversely affecting watershed conditions, some wildlife habitats and livestock forage. Sagebrush is very competitive for moisture and desirable grass species can't become established under dense sagebrush.

Other areas are dominated by blue grama and fringed sagewort and will not improve under grazing systems without some form of tillage to break up the sod.

In the 10-14 inch and 15-29 inch precipitation zones, the saline lowland, overflow, sandy, silty, clayey, shallow clay, thin silty, thin clayey and shallow range sites normally respond well to grazing management except when dominated by dense sagebrush or blue grama, or where high lime or stoniness is a factor. Some range sites including the dense clay, clay pan, shallow to gravel, gravel and very shallow range sites are normally slow to respond to management and are even slower if other factors (lime content, stoniness, dense sagebrush, etc.) are present. The 5-9 inch precipitation zone in southern Carbon County, which totals 132,848 BLM acres, is generally very slow to respond to management due to low rainfall. Stoniness, high lime and dense clays are additional limiting soil factors in the 5-9 inch rainfall area.

TABLE 3.6: OVERALL RANGE CONDITION

Management Category	Condition Acres E	G	F	P	Tame Pasture	Rock Outcrop	Unsurveyed	Total Acres	Authorized AUMs[1]
Custodial (C)	696	16,647	32,187	5,274	0	886	45,795	101,485	12,899
Maintain (M)	10,358	90,174	34,584	261	7,865	2,114	64,868	210,224	36,318
Improve (I)	3,553	32,055	36,161	6,953	5,118	3,839		87,679	13,220
	14,607	138,876	102,932	12,488	12,983	6,839	110,663	399,388	62,437

[1]Range Management Automated System (RMAS)

Source: Soil and Vegetation Inventory, BLM, 1981

TABLE 3.7: ALLOTMENT MANAGEMENT PLANS

Allotment Number	Allotment Name	Grazing System	Year Implemented	Surveyed AUMs	Avg. Actual Use—AUMs	Trend
4101	Dryhead	2 Pasture RR	1975	982	389	S
4105	Gyp Springs	3 Pasture RR	1976	1133	377	S
4111	Paradise	5 Pasture RR	1974	226	100	S
4113	Bowler Upper	3 Pasture RR	1974	874	214	U
	Bowler Lower	4 Pasture RR				
4114	Crow	3 Pasture RR	1968	161	112	S
4115	Bluewash	5 Pasture RR	1973	1739	1209	U
4921	Sage Hen	3 Pasture DR	1970	278	194*	S
4941	Lake Mason	3 Pasture DR	1970	1215	305**	S
4979	Mang	2 Pasture DR	1966	245	195	S
4988	Stanley	3 Pasture DR	1973	734	—	S
5202	Cub Creek	4 Pasture RR	1976	1505	1698	S
5210	Williams Basin	4 Pasture RR	1973	997	748	S
5213	Cottonwood	3 Pasture RR	1972	733	680	S
5217	Jack Creek	4 Pasture RR	1974	536	572	U
5225	Grove Creek	4 Pasture RR	1974	1295	581	S
5302	Burk Common	3 Pasture RR	1971	389	384	U
5304	South Pompey	3 Pasture RR	1971	391	388	S
5311	Southwest End	4 Pasture RR	1967	455	265	S
5312	Central K Henry	3 Pasture RR	1973	241	226	U
5316	Buffalo Creek	5 Pasture RR	1975	449	527	S
5318	North Otis	2 Pasture DR	1972	175	101	U
5321	South K Henry	3 Pasture RR	1973	164	219	S
5348	Hawk Creek	3 Pasture RR	1974	433	383	S
5356	Hibbard Creek	4 Pasture RR	1968	692	439	U

RR — Rest Rotation DR — Deferred Rotation U — Upward S — Static

*1-year average
**Surveyed AUMs reflect some AUMs not under actual use billing.

Source: BLM, 1982

The 51 "M" category allotments in the inventory area are currently in satisfactory condition. Four allotments in southern Carbon County were placed in the custodial "C" category due to extremely low potential for improvement. The remaining 211 "C" allotments are scattered isolated tracts that were not inventoried, no data is available on current condition or potentials for these allotments.

Crested wheatgrass was planted on many of the land utilization (formerly homesteaded) tracts at the time they were reconveyed to the government. The primary objective at that time was to stabilize the soil. In the area inventoried, there were approximately 9,200 acres of crested wheatgrass and approximately 1,500 acres that had once been crested wheatgrass but is now dominated by native species. All of the above acreages occurred in Yellowstone and Musselshell Counties. Forage production could be greatly increased by tilling, haying, fertilizing or interseeding these crested wheatgrass fields.

There are major infestations of leafy spurge in Carbon and Stillwater Counties. No specific acreages are available but substantial amounts have been identified on public as well as private lands. In recent years, the BLM has been treating approximately 45 acres annually, within a 100 acre area, with Tordon herbicide.

Riparian zones are defined as a specialized form of wetland producing specific kinds of vegetation. These zones are very important for wildlife habitat, livestock grazing, streambank stabilization and water quality. There are occasional small public land tracts that border the main rivers (Yellowstone, Musselshell, Stillwater and Clarks Fork) in addition to some islands on the Yellowstone River. However, these tracts are relatively insignificant as compared to the overall riparian status. Within the "I" allotments, there are 41 miles of floodplain type that is not a riparian zone but receives occasional overflow. Common woody species include silver sagebrush, snowberry, rose, greasewood and big sagebrush. Small areas within these 41 miles have the potential for riparian vegetation.

Threatened and Endangered Plants

Two plants currently being reviewed as threatened or endangered, and identified on the Montana Bureau of Land Management list of sensitive species, may exist within the resource area. They are *Eriogonum lagopus* (a buckwheat) and *Rorippa calycina* (a watercress). Neither has been located to date.

Livestock

Ranches holding a BLM grazing preference in this resource area are primarily cow/calf type operations. There are currently 333 operators and 62,437 active animal unit months (AUMs) (Range Management Automated System—RMAS) authorized in the resource area. Most of these AUMs are in Carbon, Yellowstone and Musselshell Counties. The total numbers of livestock authorized include 57,781 cattle, 22,388 sheep and 133 domestic horses. These figures indicate the amount of livestock dependent on public lands at some time during the year. Livestock productivity varies widely within the resource area depending on the management program of the operator, breeds used and range conditions.

The demand for currently allocated forage appears to be relatively stable. Additional demand seems to follow cattle price cycles, increasing when prices are up and vice versa. At the time of adjudication in the 1960's, those AUMs of priority in excess of the surveyed capacity were held in suspended-nonuse. There are 7,785 AUMs currently carried as suspended-nonuse.

Grazing Management

The 1981 Ecological Site Inventory, described in the Vegetation section of this chapter, was designed to update and refine existing soils information to the extent range sites could be defined within the soil mapping units. In addition to mapping range sites, an ecological range condition was assigned to each site (see Table 3.5). This condition estimate is based on the current vegetative composition and production as compared to a comparable range site under climax or pristine conditions. Vegetative types were also identified, the canopy coverage of shrubby species was estimated and a cursory estimate of trend was made.

The information collected during this inventory will be used to implement the BLM Grazing Management Policy, which directs the Bureau to adopt a selective management approach. Selective management will be based on identification of allotments or areas sharing similar resource characteristics, management needs and the potential for resource and economic improvement. Similar allotments will be identified as belonging to one of three categories for which BLM's objective is to: maintain "M" their current satisfactory condition; improve "I" their current unsatisfactory condition or manage the allotments custodially "C" while still protecting existing resource values. Final categorization resulted in 156 allotments in the "M" category, 22 in the "I" category and 215 in the "C" category.

There are currently 24 implemented allotment management plans within the resource area (see Appendix 1.8). Most were implemented in the late 1960's and early 1970's and the oldest of these has completed five grazing cycles. Of these 24 AMPs, 19 are rest rotation and the remainder are deferred rotation. Approximately 35% (154,629 acres) of the public lands administered by the BLM within the resource area are under implemented AMPs. Generally, these AMPs are meeting the objectives set forth in the plans. Six of these AMPs fall into the "I" category and will require revisions. The remaining 16 are in the "M" category and will maintain the current situation.

The three areas in the resource area where vegetative manipulations should occur are areas containing dense stands of sagebrush, crested wheatgrass and noxious weeds (primarily leafy spurge). The 1981 inventory also resulted in mapped vegetative communities and estimated shrub canopy coverage. Where shrubs occurred, they were grouped into one of three categories: 05%, 5-25% or 25+% canopy coverage. Of the total Federal acres surveyed, about 157,000 acres were of a sagebrush (*Artemesia tridentata*) aspect. About 30,000 acres of these public lands had a canopy coverage in excess of 25% (Ecological Site Inventory, 1981). Dense stands of sagebrush substantially reduce both the quality and amount of vegetative production, thus adversely affecting watershed conditions, wildlife habitat and livestock forage.

Crested wheatgrass had been planted on much of the BLM acquired lands (land formerly homesteaded and then bought by the government under the Bankhead-Jones Act of 1937). The primary objective for this was to stabilize the soil. The area inventoried contained approximately 9,200 acres of crested wheatgrass and approximately 1,500 acres that had once been crested wheatgrass, but is now dominated by native species. All of the above acreages occur in Yellowstone and Musselshell Counties.

Another area where vegetative manipulation could occur is where noxious weeds occur. Currently, leafy spurge is the dominant weed problem in the Billings Resource Area. The major infestations are in Carbon and Stillwater Counties. No specific acreages are available, but substantial amounts have been identified on public as well as private lands. In recent years, the BLM has been treating approximately 45 acres annually with Tordon.

Timber Management

There are approximately 14,225 acres of BLM managed timber throughout the Billings Resource Area. This timber is found primarily in the Pryor, Beartooth, Bull and Snowy Mountains.

The commerical saw timber species present within the resource area, in order of abundance, are ponderosa pine, Douglas fir, lodgepole pine, Engelmann spruce and alpine fir (see Table 3.8). Stands vary in age and size from young reproduction timber (less than 10 years old) to over mature saw timber (200 years or more old).

Altitude generally dictates the type of timber overstory present. The most common species of river and streambank overstory vegetation are cottonwood and willow. Juniper, interspersed with ponderosa pine, is found at lower elevations. Quaking aspen, growing in the more mesic areas, is found at mid and high elevations. Conifer species, including ponderosa pine, Douglas fir, lodgepole pine, Engelmann spruce and alpine fir, are generally found at mid to high elevations.

The western spruce budworm has infested portions of the Billings Resource Area. Douglas fir trees of all ages in the Pryor Mountains and in areas south of Big Timber, Montana are being destroyed by the insect. The mountain pine beetle is also present. It infests and kills ponderosa pine and lodgepole pine. However, there are no presently known epidemic populations on BLM-administered lands.

TABLE 3.8: COMMERCIAL SAW TIMBER SPECIES

COMMON NAME	SCIENTIFIC NAME
Engelmann spruce	Picea engelmannii
Alpine fir	Abies lasiocarpa
Ponderosa pine	Pinus ponderosa
Douglas fir	Pseudotsuga mengiesii
Lodgepole pine	Pinus contorta
Limber pine	Pinus flexiius
Quaking aspen	Populus tremulsides
Juniper	Juniperus spp.
Cottonwood	Populus spp.
Willow	Salix spp.

Source: The Textbook of Dendrology, 1958

Much of the BLM timber in the resource area, with the exception of the Twin Coulee Wilderness Study Area (WSA), is located on small, isolated tracts lacking public access. In most cases, the tracts do not contain timber of sufficient quantity and quality to make advertised sales necessary, except for the 4,612 acres of productive forest in the Twin Coulee WSA.

Given the existing land pattern, the lack of public access and small volume of timber products available in these tracts, the most effective way to conduct a forestry disposal program in the resource area is by negotiated sales. A timber buyer, logging private timber adjacent to BLM managed land, already has access roads and can afford to buy a small BLM sale (less than 50 thousand board feet) without additional move-in expenses. Advertised timber sales would be the exception rather than the rule.

Table 3.9 describes the timber sales in the Billings Resource Area since 1977.

TABLE 3.9: FOREST PRODUCT SALES SINCE 1977

Product	Number of Sales	Units	Value
Saw Timber	10	259 MBF	$7,269.00
Posts and Poles	5	2,700 ea.	214.00
Christmas Trees	1	100 ea.	40.00
Firewood	3	20 cords	10.00
TOTALS	19		$7,533.00

Source: BLM, 1982